# HOWARD'S
# CYCLE OF THE SEASONS
# OF BRITAIN.

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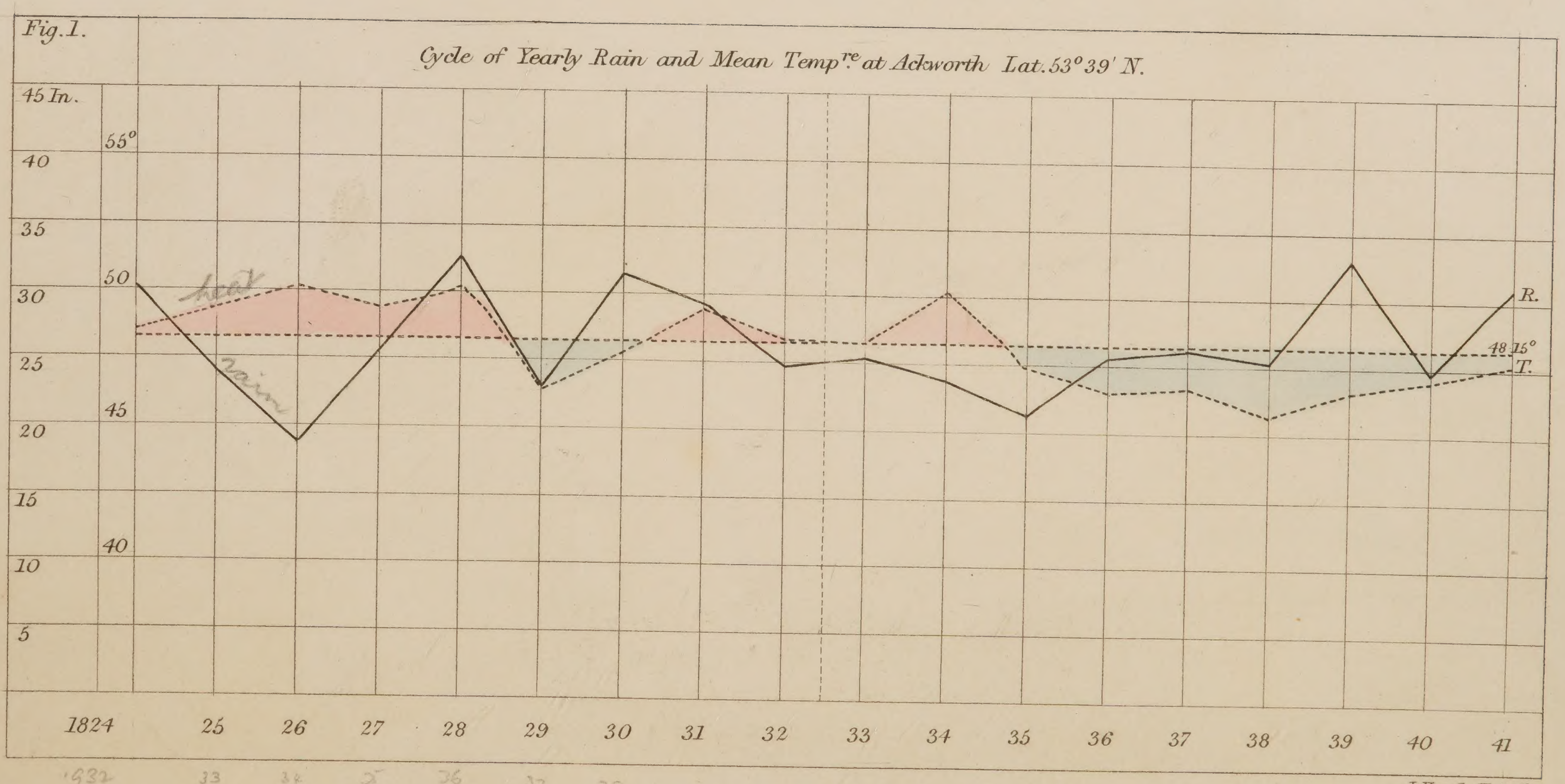
Fig. 1.

Cycle of Yearly Rain and Mean Temp$^{re}$. at Ackworth Lat. 53° 39′ N.



J. Henshall Sculp.

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# A
# CYCLE OF EIGHTEEN YEARS
# IN
# THE SEASONS OF BRITAIN;

DEDUCED FROM

METEOROLOGICAL OBSERVATIONS

MADE AT

ACKWORTH, IN THE WEST RIDING OF YORKSHIRE,

FROM 1824 TO 1841;

COMPARED WITH OTHERS BEFORE MADE FOR A LIKE PERIOD
(ENDING WITH 1823) IN THE VICINITY OF LONDON.

By LUKE HOWARD, Esq., F.R.S., &c.

WITH FIVE PLATES.

LONDON:
JAMES RIDGWAY, PICCADILLY;
HARVEY AND DARTON, GRACECHURCH STREET;
BAINES, LEEDS; LUCAS, PONTEFRACT.
1842.

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RIGHT HON. THE EARL FITZWILLIAM,

*&c. &c.*

MY LORD,

YOUR Lordship's extended interest in the agriculture of the district to which these observations more immediately apply, and your known personal attention to the subject treated, might suffice (without more public grounds) to justify my freedom in inscribing to you this attempt to make *useful and important deductions* from a series of Tables of the weather. But I have a higher plea—Your Lordship is a PATRIOT; one who knows how to find, *in the well-being of a whole community, his own peculiar interest and happiness.* And this little work claiming also to stand, if on any public ground of merit, on its usefulness *to the most useful portion of the community,* I may reasonably hope it will meet with Your Lordship's approval and patronage.

I am, My Lord,

Your Lordship's faithful friend,

THE AUTHOR.

*Tottenham, March* 31, 1842.

# A CYCLE OF EIGHTEEN YEARS IN THE SEASONS OF BRITAIN, &c.

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THE fact of a periodical revolution, bringing alternate warmth and coldness through successive trains of seasons in our variable climate, is now ascertained beyond controversy; and it becomes in consequence an important object, to ascertain the nature and extent of these changes, and their effects on our *agriculture* especially; that we may the better avail ourselves of the favourable, and provide against the adverse.

In my account of the climate of London, first printed in 1818—1820, I gave a view of these changes on the basis (which my observations then seemed to present) of *alternate periods of seven and ten years,* the former *ascending,* the latter *descending* in the scale of heat. I then admitted, from appearances, the probability of spaces between these successive periods not agreeing with the rule abovementioned, and answering to the "intercalations" of an imperfect calendar. Having since pursued the subject further, I find these spaces, or interposed years, to be necessary parts of the scheme at large; which now resolves itself into *a cycle of eighteen years,* in which our seasons appear to pass through their extreme changes in respect of warmth and cold, of wet and dryness. I have given an account already to the Royal Society of my views on this subject, as regards the seasons near London, and what relates to the periodical variations of the barometer from year to year in this neighbourhood is inserted in the Transactions*. My present object is, to bring in confirmation of these views *the facts of a new period, observed in a new locality,* and that differing so considerably in latitude from the former, as to justify the inference that the periods are not confined to any part of our island, but will be found, variously modified, in all.

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* Philosophical Transactions for 1841, Part. II.

Referring to the papers abovementioned for a variety of facts relating to atmospheric periodicity, stated in a more elaborate way, I shall here briefly analyse the results of the Ackworth register, and apply them to my object; saying little about the *barometer* however, because the present observations on this instrument, however constantly made from day to day, have not the comprehensive character of those insisted on in my former papers; *which were taken from the face of a registering clock.* The Tables annexed to this paper, then, comprise the *Results of a daily meteorological register,* kept at my instance, and with instruments furnished by myself, *at the Friends' Public School in Ackworth.* I have observations, not so continuous, made at my own residence there; by collation with which in many parts I have satisfied myself that I can depend on *these,* for the purpose to which they are here applied, of deducing the differences of seasons from previous and subsequent ones of like denomination, *by comparison with each other.*

As on former occasions, I shall have recourse to *diagrams,* which present to the eye with ease what figures would convey but slowly to the mind. The *dotted* curve, or flexuous line in fig. 1. shows the variation from year to year of the mean temperature, or *average heat* of the year, the *Mean of the climate* (or average of all the observations of these eighteen years) being 48°·126. The nine years from 1824 to 1832 average 48°·879; the nine years from 1833 to 1841 give 47°·374. The difference of 1°·40 is about equal to the difference in warmth between Ackworth, N. lat. 53° 38′ 57″, and London. I therefore call the former nine the *warm,* and the latter nine the *cold* years of the cycle. The curve shows palpably the bulk of the years of high temperature on the *right,* and of those of low temperature on the *left* of the dividing line, but with two striking exceptions. There is a very cold year, 1829, among the *warm,* and a very warm year, 1834, among the *cold*; and these considerably reduce the difference between the two averages: the comparison or contrast holds best, therefore, *among the years in detail.*

The *full* flexuous line in fig. 1. shows the variation, from year to year, of the total rain collected by the gauge in each. It is not here as with the temperatures; the amount of *Rain* is balanced, or nearly so, in each nine years. Thus out of 472·93 inches fallen in the whole cycle, 238·60 inches appear to have fallen on the *warm,* and 234·33 inches on the *cold* side, making the annual averages respectively 26·51 and 26·04 inches, nearly; which is about *an inch more* on the whole *per annum* than is found to fall near London—the level being at the ground, in both. If we now look through the *curve* (I beg pardon of mathematicians for applying the term to such a line,) we shall probably be first struck with an extreme of dryness (1826) followed by an extreme of wetness (1828) on the *warm* side; then, with a gradation from *very* wet (again following very dry) in 1830, to *very* dry in 1835; and this again mounting by steps to extreme wet again in 1839. In fact, ten years, from 1830 to 1839, show a gradual decrease and again an increase of rain, protracted through the half-cycle, while eight years from 1840 to 1829 (passing thus back to make the cycle) show repeated and more extended oscillations, performed in shorter times; yet with results so nearly the same, that the first set of years, here specified, show an average rain of 26·36 inches, while the second set average 26·16 inches. Again, on comparing rain with temperature, we find 1826 in the extreme at once of *warmth* and *dryness*, and 1839 in those of *wet* and *coldness*: but 1828 (in the extreme of wetness) is equal in *heat* to the dry 1826; and 1829 is both *dry* and very *cold*. The quantity of rain, therefore, is not regulated by the *temperature* of the year: we may get it with *heat*, brought by winds highly vaporised from the tropic; or with *cold*, from the condensation effected by the approach of northern air to our own atmosphere, previously charged with vapour to the full; and the dryness of 1829, with so much of *cold*, may have been the result of the great deposition of rain in the previous season. The only rule, then, that prevails throughout, seems to be *compensation*; a wet year against a dry one, &c., and so of whole runs of seasons; and we must examine the *winds* for the cause.

This I have done in my paper before the Royal Society alluded to above; but the subject, complicated as it is with the moon's intricate orbit, and her varying influence on the currents that sweep these islands, is much too extended for the compass of this paper. We have to do, here, not so much with causes as with the effects they produce; a knowledge of which must necessarily go before the other. I shall proceed therefore at once, from the review of the rain and temperature of *whole years*, to an analysis of the distribution of these through the *several months* of the year; which will let us probably into the secret of the difference, *under equal quantities of rain*, of the warm from the cold side of the cycle; as regards the most important of its effects, *the fruitful or unfruitful character of our seasons.*

The full flexuous line in fig. 2. presents the monthly rain, in its total amounts under each month, for the *nine years* 1824 to 1832, or warm period; the dotted curve, the same for the *nine years* 1833 to 1841, or *cold* period of the cycle. I shall compare these with the temperature in another figure; the present object is to show the remarkably different *distribution* of the like *quantity* of rain, in each. The warm period, then, shows *December* barely dry, its rain being three-tenths of an inch below the mean betwixt the driest and wettest months, which is at 19·59 inches. *January, February* and *March* are in the extreme of *dryness.* In *April* of this period, the rain suddenly mounts up to a point full three inches above the mean, and descends again three and a half inches below it, to make us a fine *May.* The months of *June* and *July,* though high in the scale of rain, have the advantage (the former considerably) in dryness of those of like denomination in the cold period. But in *August* and *September* we see the case reversed; the amounts of rain in the warm *exceeding* (by about five inches in each) those of the cold period. *October* is wet in both nearly to the same degree; and by the bye I may here observe, that the rains in this month fall mostly by night; verifying a remark I heard many years since from a friend, that "there are always twenty fine *days* in October." *November,* though wet, is drier on the warm side by a quantity exceeding two and a half inches on the cycle: of *December* we have treated as regards this side—to turn now to the other.

In the cold period, *December* is very dry; which dryness is ominous of wet in *January, February* and *March*; carrying the rain in these to an excess over the former period of four and a half, seven and three quarters, and three inches, respectively. To these succeeds *a dry April* (perhaps the worst feature for agriculture of the whole), the rain falling short by *nine inches* of the former total. This want is hardly supplied by the more copious rains in *June*; for they come usually accompanied by far too much of *wind,* in the summer of the cold period. *August* and *September* (contrary to what the inexperienced would predict) are much the *drier* months in the cold years: yet the lower temperature and cloudy sky counteract the early ripening of the crops. *November* mounts up, in this period, to the second place for wetness (it has the *first* in the neighbourhood of London) and often completes the destruction of what the drier weather of the preceding months had come too late to enable us to save. I shall not need (were I more capable of the office) to point out to the experienced farmer the advantages and disadvantages *to* *him* of these different arrangements. They are the work of the all-wise Creator; ordered no doubt for the best *on the great scale of things.* It is for us, instead of vainly wishing them otherwise, to turn to the best account (which we surely may, with the helps derived from accurate observation and a full record,) the opportunities they present. The results in figures, from which the curves I have hitherto treated were laid down, will be found in Tables in the following pages.

Fig. 3. gives the rain under each month, *for the whole eighteen years,* represented by a full line; in connexion with the average temperature of each month for the like series of years, in a *curve* (which may be so called without a qualifying remark) corresponding as nearly as those in my 'Climate of London' with *the curve of the sun's declination*; which I have placed, in a fine dotted line, in connexion with both. This diagram is instructive, as regards the average increase of our rains as the sun approaches us from the south, and their falling off in quantity as he recedes towards the tropic of the other hemisphere: and it serves well for a test *of the completeness of the account of temperature through the cycle*; the solar and the thermometric curve agreeing in form, with the like exceptions, as about London; of an accelerated rise in the spring and a retarded fall in the autumn; which I have shown in my work above mentioned to be the necessary conditions of our annual variation. The results in figures belonging to this beautiful curve will be found in the Tables further on.

In figures 4, 5, 6 and 7, I have given the rain and temperature *of the four seasons of the year,* through the cycle here treated; the numbers belonging to which will be found at the foot of each yearly table, 1824, *Winter* (Jan. to Mar.), &c. at the end. To have treated these curves in detail would have involved a repetition, in substance, of much of what has been said upon the monthly averages. They will be found upon examination to present many curious gradations and coincidences, in the increase and decrease of the rain and warmth of each season: they show also at a glance the difference, in each, between the warm and cold sides of the cycle: also what summers were particularly warm, and what winters cold; with the nature of the changes, from year to year, throughout, in our most capricious season, *the spring.* As to *rain,* we see at once that the wet of 1824 and 1827 occurred chiefly in the *Autumn*; as did also the drought of 1826 and 1829: that, in the very wet 1828, the rains fell chiefly in the *summer*, so that we had potatoes of a pound and a half in weight, and the crop unequalled in the whole cycle: after which the supply of this season fell off gradually to 1832, was renewed in 1834 and balanced then by a dry *autumn*. In 1839 we see summer and autumn wet; in 1840, both seasons dry: but the most remarkable feature, perhaps, of the whole is the opposition of the curves of winter and spring from 1832 to 1841; the former plainly robbing the latter as it advances in the fore part of the period, and restoring the amount in the latter part. It is to show this peculiarity that I have placed the curves in the order they are found in, the winter one lowest. The rains of the *summers* 1835 to 1838 appear to be given away partly to the autumn, partly to the winter; but it is needless further to anticipate the reader in his remarks.

The yearly *mean heights of the barometer* for the cycle, taken at Ackworth School, are as follows:—

| | | | |
|---|---|---|---|
| 1824. | 29·75 inches. | 1833. | 29·81 inches. |
| 1825. | 29·93 | 1834. | 29·98 |
| 1826. | 29·91 | 1835. | 29·86 |
| 1827. | 29·84 | 1836. | 29·73 |
| 1828. | 29·83 | 1837. | 29·80 |
| 1829. | 29·84 | 1838. | 29·76 |
| 1830. | 29·81 | 1839. | 29·78 |
| 1831. | 29·82 | 1840. | 29·84 |
| 1832. | 29·93 | 1841. | 29·70 |

Mean of warm period 29·851 inches. Mean of cold period 29·807 inches.

The mean of the whole cycle is 29·829 inches. It appears, then, that the warm side has the higher average of pressure by ·0 44 in. This is consistent with my former observations, as to the greater mean height belonging to *the warmer portion of the year*; which the reader will find in my 'Climate of London,' vol. ii. p. 281, 1st edit.; vol. i. p. 207, 2nd edit. And the same reasons, which there apply to single years, will be found here to suit periods also: for the period from 1815 to 1823 averaged at *Tottenham* 29·788 inches, and that from 1824 to 1832, 29·830 inches; giving thus an excess of pressure to the warm years over the preceding cold ones, of·0 42 in. My clock takes in the greatest depressions, and makes the mean lower than it is obtained in the ordinary way: so that these averages of the School and Tottenham, though comparable respectively *at each station*, are not so with each other. As it is, they agree with remarkable nearness in the amount of excess of the warm period.

The *yearly mean temperatures* for the cycle at Ackworth are as follows:—

| | | | |
|---|---|---|---|
| 1824. | 48°·53 | 1833. | 48°·36 |
| 1825. | 49·45 | 1834. | 50·08 |
| 1826. | 50·25 | 1835. | 47·31 |
| 1827. | 49·19 | 1836. | 46·52 |
| 1828. | 50·26 | 1837. | 46·66 |
| 1829. | 46·64 | 1838. | 45·79 |
| 1830. | 47·58 | 1839. | 46·69 |
| 1831. | 49·57 | 1840. | 47·02 |
| 1832. | 48·44 | 1841. | 47·74 |

Mean of warm period 48°·879. Mean of cold period 47°·374. Mean of whole cycle 48°·126: excess of first nine years 1°·405.

If we leave out 1829 on one side, and 1834 on the other, and average the remaining years, they come out thus: the first eight years 49°·159, the latter 47°·011: difference 2°·148. Now the nine years from 1815 to 1823 average in the neighbourhood of London 49°·065, and the following nine years, 1824 to 1832, 50°·137: the difference in favour of the warm period being 1°·072. I might go on to prove another warm period, antecedent, and ending with 1814, averaging 49°·383; but the locality (Plaistow) differs, and the observations cannot so properly be brought into the comparison, though they show a small excess. Moreover, the method of computing by whole years and calendar months may bring out inaccurate results in an extended examination. I have proceeded, in my paper now with the Royal Society, on the solar year and the lunar divisions, which are more agreeable to nature; the cycle of eighteen years depending on these principles. The reader will find the subject of periods of temperature largely treated in my published work above mentioned; which, *as regards its details,* is not in any degree superseded by the present paper.

The *rain* of the cycle at Ackworth is as follows:—

| | | | |
|---|---|---|---|
| 1824. | 30·51 inches. | 1830. | 31·58 inches. |
| 1825. | 24·22 | 1831. | 28·37 |
| 1826. | 18·74 | 1832. | 24·94 |
| 1827. | 25·04 | 1833. | 25·06 |
| 1828. | 32·35 | 1834. | 23·74 |
| 1829. | 22·85 | 1835. | 21·19 |

| | | | |
|---|---|---|---|
| 1836. | 25·21 inches. | 1839. | 33·16 inches. |
| 1837. | 25·39 | 1840. | 24·75 |
| 1838. | 25·02 | 1841. | 30·81 |

Rain of the warm years 238·60 inches; of the cold years 234·33 inches. Rain of the whole cycle 472·93, or *per annum* 26·27 inches; the warm side averaging 26·51 inches, the cold 26·037 inches. I have found cause, on examining into past periods, to conclude that the small excess of rain here found on the warm side is not a constant result; but that the *cold* may sometimes be the wetter. The main point affecting our harvests appears to be the different distribution of the rain *within the year* in each period, to which we now proceed: but first of the whole cycle.

The following are *the total amounts of rain* for *each month* of the year, through the cycle from 1824 to 1841; to which are annexed the monthly averages of heat, or *the mean temperature of each month* for these eighteen years. The reader will see, on comparing the latter with the curve of the sun's declination (see fig. 3.), that the warmth and coldness, thus averaged on a cycle, follow pretty strictly (though at some distance, as I have shown in the 'Climate of London,') *the proportionate height of the sun* through the seasons; ascending thus to July and descending again to January: the rain itself being somewhat similarly affected, but with a diminution of quantity in the spring months, and an addition in the autumnal, *depending on other causes.* I have treated these also in my work above mentioned, under the head of "Rain," to which I must here refer.

| | Rain. | | Mean Temp. |
|---|---|---|---|
| January . . . . . | 29·88 inches. | | 35°·734 |
| February . . . . | 31·16 | | 38·176 |
| March . . . . . . | 25·97 | | 41·600 |
| April . . . . . . . | 36·49 | | 45·852 |
| May . . . . . . . . | 32·99 | | 51·699 |
| June . . . . . . . | 45·96 | | 57·921 |
| July . . . . . . . . | 54·52 | | 60·717 |
| August . . . . . . | 44·81 | | 59·513 |
| September . . . | 48·65 | | 54·947 |
| October . . . . . | 43·46 | | 49·466 |
| November . . . | 46·96 | | 41·786 |
| December . . . . | 32·08 | | 39·413 |
| Total . . . . . . . | 472·93 | Mean of year . . | 48·069 |

All which the reader is requested to compare with the curves.

Now, for the distribution to the several months, in the *warm* and in the cold *period*, the following are the results in figures :—

| | 1824–1832. | 1833–1841. | |
|---|---|---|---|
| January | 12·67 inches. | 17·21 inches. | |
| February | 11·75 | 19·41 | |
| March | 11·51 | 14·46 | |
| April | 22·75 | 13·74 | |
| May | 16·11 | 16·88 | |
| June | 21·58 | 24·38 | |
| July | 26·85 | 27·67 | |
| August | 24·77 | 20·04 | |
| September | 26·98 | 21·67 | |
| October | 22·17 | 21·29 | |
| November | 22·17 | 24·79 | |
| December | 19·29 | 12·79 | |
| Total in the warm years | 238·60 | 234·33 | Total in the cold years. |

Of these quantities we have, on the *warm* side, for

| | |
|---|---|
| January, February, March | 35·93 inches. |
| April, May, June | 60·44 |
| July, August, September | 78·60 |
| October, November, December | 63·63. |

And, on the *cold* side, for

| | |
|---|---|
| January, February, March | 51·08 inches. |
| April, May, June | 55·00 |
| July, August, September | 69·38 |
| October, November, December | 58·87. |

The reader will be pleased to compare the numbers with the curves in fig. 2. I have already made such remarks on these as may suffice for his help.

On bringing into comparison the curve of the rain-cycle, 1824 to 1841, with that for the preceding cycle, 1806 to 1823, in the neighbourhood of London, the following differences appear. At *London*, January, in the whole eighteen years, has 10 inches *more* rain; March, 5 inches *more*; April, 7 inches *less*; May, 6 inches *more*; June, 18 inches *less*; and July about 10 inches; August and September have respectively 14 inches and 20 inches *less* at London. The two following months nearly agree in amount with Ackworth (as does February), but December was 20 inches drier at London. With these differences, the two curves still show the common feature of a general accordance with the sun's declination *through the fore-part of the year*: but this is done away in the London curve, afterwards, by the dryness of August and the extreme wetness of November and December. Were the several cycles of amounts of rain, which we now possess, averaged for each year upon nine successive years, and thus reduced to easy curves (as I have done with the barometrical heights), these would undoubtedly present some striking features, leading to the true theory of our rains in Britain; but this is more than I can here undertake to produce.

The following are observations made, with one of my gauges, by my friend Thos. Fowler, Esq., at Tottenham, for seven years past, placed in comparison with those of the school at Ackworth.

| | in. | | in. |
|---|---|---|---|
| 1835. year's rain at Ackworth | 21·19 | At Tottenham | 24·43 |
| 1836. | 25·21 | | 29·76 |
| 1837. | 25·39 | | 20·61 |
| 1838. | 25·02 | | 23·13 |
| 1839. | 33·16 | | 28·64 |
| 1840. | 24·75 | | 21·79 |
| 1841. | 30·81 | | 31·34 |
| Total in seven years...... | 185·53 | | 179·70 |

The annual averages thus obtained are for Ackworth 26·50, and for Tottenham 25·67 inches. If we compare the amount, throughout, we shall see the *wet* years coinciding, except in 1836; the *dry* years set against *mean* ones, each way; and the total amounts affording each an average very near to that of the station itself: the two mean years, 1836 and 1837, at Ackworth, balance the wettest and the driest that occur at Tottenham. The whole confirms a remark I have often made in passing to and fro, that we seldom see the Trent and the Thames full with rains, together; their estuaries communicating with different portions of the surrounding sea, and the respective districts that feed their springs requiring somewhat different winds to furnish them with vapour.

After acknowledging my obligations to the present and former Superintendents, and the successive Clerks, of the Institution at Ackworth, it is proper I should caution my reader against *expecting too much* from the information here presented to him. Should he look for the *same mean temperature*, and the *same amount of rain*, in each returning year of the coming cycle, as are found recorded of a corresponding one in the past, he will probably meet with frequent disappointments; and this more especially in a locality somewhat different. We are yet far from being able to predict seasons in meteorology with the like certainty of date as the astronomer does the coming phænomena of the heavens; and it is even possible that, from the very nature of the causes concerned, we may never arrive at this. The judicious observer, finding certain facts fully ascertained and clearly noted for him, *will know how to make use of these for himself*; and by watching their occurrence in detail, making notes as he proceeds, will endeavour to feel his own way towards the future; independently of empirical and fallacious *predictions.* This is the kind of service which I expect my present labour to render to the country; besides gratifying a reasonable curiosity as to the past. We do not expect to become skilful in other arts without a due share of study and practice; but we seem to forget this self-evident truth, when we take up that of foretelling the weather. The facts here detailed cannot fail to be useful to such as will be at the trouble to examine and compare them, though the inferences they may draw from them should differ. And admitting only that, in the course of years here treated, we experience in succession the various degrees of warmth and coldness, of rain and dryness incident to our climate, it must needs help the farmer, the market-gardener, the planter or nurseryman, the grazier, the sheep-master, to have before him such an approximation to the times and order of their occurrence.

A comparison in detail of the warmth and rain of successive seasons with *the yield and quality of the harvest* belonging to them, would have formed, perhaps, a desirable appendage to the *meteorology* of my paper. But I have not before me the materials for this: and to have waited to collect them would have caused me much delay in publishing it, which I have reasons for wishing to avoid. The subject, moreover, viewed in this light, is a very copious one. It is not alone the grower of *corn* that is interested in a warm or a cold, a dry or a wet season; there are a variety of rural occupations, and of trades and manufactures dependent on them, equally concerned in these. And we have the satisfaction of thinking, that these are severally the best judges of their own needs and occasions; that each will be best able to avail himself to purpose of the meteorological facts, established for him by the labours of men of science.

There is a class of persons, however, to whom the paper may be immediately acceptable, and possibly also useful in regulating their future plans. The poor invalid may be soothed, and those of delicate constitutions encouraged, by the immediate prospect of a nine years' run of seasons having, with little exception, *the higher temperature of our climate.* It may be the means of inducing these to make trial at least of one or two of these, before they resort to other skies more favoured by natural position, but extending over countries far less desirable as residences to a truly British mind. And medical gentlemen, when they have read and considered what is here laid before them, may find arguments in it to strengthen such a conclusion.

At the present moment, when we are debating with earnestness the question of our corn-importation, and while some are looking for an absolute scarcity, it cannot be uninteresting to public men to know what, in a scientific point of view, are the bearings of the question of *climate* and *seasons* on this other and more tangible one. That they are on the whole highly favourable, will, I hope, be an announcement giving pleasure to both sides: yet here, also, I must put in a word of caution. Plenty, I have shown, as regards our grain-crops, is dependent partly on a sufficiency of *warmth on the whole year,* partly on *rains administered in due season.* But we *may* have a season or two to go through, in which, though our personal comfort may be increased by dry and hot weather, the crops may not be so well fed, or the sheep so well fatted, as we would have them. But we abound in resources (through the goodness of God to his creatures), and may cheerfully proceed to do our duty and make use of them, in reliance on the Divine Providence; happy also if, through His grace, we have learned to feel for the distress of others, and do for them *in all respects* that which we would they in like circumstances should do for ourselves. This is the great lesson which many of us have yet to learn, more perfectly, to become more safely *proud* (in a good sense of the term) of the name of *Christian.* My countrymen will, I am sure, not be offended by this hint, from one now nearly of an age to be released from all public engagements; but who finding the matter before him, and apprehending a public service in it, could not well forbear the present.

*Tottenham, Middlesex,*
*March* 31, 1842.

## *Tables of the Barometer, Temperature and Rain, with Notes on the Seasons.*

Mean height of the Barometer, Mean Temperature and depth of Rain in each month, at Ackworth, Yorkshire, through a Cycle of Eighteen Years.

| | 1824. | | | 1825. | | | 1826. | | |
|---|---|---|---|---|---|---|---|---|---|
| | in. | ° | in. | in. | ° | in. | in. | ° | in. |
| January | 29·90 | 39·53 | 0·60 | 30·09 | 39·03 | 0·80 | 30·00 | 32·32 | 1·05 |
| February | 29·74 | 39·36 | 0·89 | 30·04 | 39·14 | 0·34 | 29·78 | 42·84 | 2·23 |
| March | 29·71 | 40·39 | 1·82 | 30·08 | 40·80 | 1·28 | 29·92 | 41·82 | 0·45 |
| April | 29·79 | 44·89 | 1·22 | 29·94 | 47·22 | 4·56 | 30·02 | 49·95 | 1·67 |
| May | 29·91 | 50·52 | 1·10 | 29·92 | 52·11 | 2·52 | 30·03 | 51·19 | 0·79 |
| June | 29·84 | 56·28 | 4·59 | 29·89 | 58·17 | 1·53 | 30·20 | 63·96 | 0·37 |
| July | 29·91 | 62·40 | 0·43 | 30·09 | 62·80 | 0·76 | 29·91 | 64·72 | 1·65 |
| August | 29·86 | 59·60 | 1·67 | 29·84 | 61·58 | 3·28 | 29·89 | 64·90 | 1·00 |
| September | 29·76 | 56·60 | 6·36 | 29·83 | 59·81 | 0·85 | 29·85 | 56·90 | 5·10 |
| October | 29·54 | 48·49 | 6·07 | 29·81 | 52·32 | 2·48 | 29·75 | 51·84 | 1·31 |
| November | 29·45 | 43·75 | 2·25 | 29·87 | 40·52 | 2·86 | 29·78 | 40·76 | 1·87 |
| December | 29·66 | 40·54 | 3·51 | 29·71 | 39·92 | 2·96 | 29·80 | 41·76 | 1·25 |
| Whole year | 29·75 | 48·53 | 30·51 | 29·93 | 49·45 | 24·22 | 29·91 | 50·25 | 18·74 |
| Winter (Jan. to Mar.) | | 39·76 | 3·31 | | 39·66 | 2·42 | | 38·99 | 3·73 |
| Spring (Apr. to June) | | 50·56 | 6·91 | | 52·50 | 8·61 | | 55·03 | 2·83 |
| Summer (July to Sept.) | | 59·20 | 8·46 | | 61·39 | 4·89 | | 62·17 | 7·75 |
| Autumn (Oct. to Dec.) | | 44·26 | 11·83 | | 44·25 | 8·30 | | 44·79 | 4·43 |

NOTES. 1824.—The driest *January* and *July*, and the wettest *September* and *October*, of the cycle of eighteen years: compare these months in 1825, 1826, 1827, 1830, 1833, 1835, 1841. The ~~mildest and the~~ wettest *December*: compare the remaining years.

1825.—The wettest *April* of the cycle: compare 1828, 1830, 1833. *September* the driest but one: compare 1832. The driest *February* but one: compare 1832.

1826.—The driest *year* of the cycle, and making with 1828 the two of highest temperature: it has by far the hottest summer: compare July—September in the remainder. The driest *June* in the cycle, and the warmest: compare 1827, 1828, 1837. The *January* among the coldest: compare forward.

Mean height of the Barometer, Mean Temperature and depth of Rain in each month, at Ackworth, Yorkshire, through a Cycle of Eighteen Years.

| | 1827. | | | 1828. | | | 1829. | | |
|---|---|---|---|---|---|---|---|---|---|
| | in. | ° | in. | in. | ° | in. | in. | ° | in. |
| January | 29·78 | 35·05 | 1·58 | 29·87 | 40·11 | 3·51 | 29·82 | 32·11 | 0·65 |
| February | 30·04 | 34·53 | 0·95 | 29·77 | 40·97 | 1·11 | 30·02 | 38·52 | 1·79 |
| March | 29·55 | 42·98 | 2·85 | 29·83 | 44·09 | 1·58 | 29·85 | 38·81 | 0·32 |
| April | 29·92 | 48·13 | 0·78 | 29·72 | 46·93 | 4·01 | 29·47 | 44·22 | 2·94 |
| May | 29·70 | 52·78 | 1·67 | 29·84 | 53·38 | 1·82 | 30·00 | 53·76 | 0·36 |
| June | 29·85 | 58·52 | 0·66 | 29·93 | 60·10 | 1·27 | 29·95 | 58·47 | 2·08 |
| July | 30·02 | 62·71 | 1·39 | 29·64 | 61·44 | 9·48 | 29·71 | 61·45 | 3·00 |
| August | 29·97 | 58·39 | 2·79 | 29·82 | 59·74 | 1·28 | 29·75 | 57·68 | 5·19 |
| September | 29·95 | 56·83 | 1·76 | 29·92 | 56·66 | 2·76 | 29·68 | 52·41 | 3·27 |
| October | 29·72 | 53·48 | 5·81 | 30·01 | 50·00 | 0·92 | 29·91 | 47·32 | 1·21 |
| November | 29·94 | 43·56 | 2·56 | 29·81 | 45·00 | 2·77 | 29·93 | 40·99 | 1·27 |
| December | 29·69 | 43·27 | 2·24 | 29·82 | 44·67 | 1·84 | 30·00 | 33·96 | 0·77 |
| Whole year | 29·84 | 49·19 | 25·04 | 29·83 | 50·26 | 32·35 | 29·84 | 46·64 | 22·85 |
| Winter (Jan. to Mar.) | | 37·52 | 5·38 | | 41·72 | 6·20 | | 36·48 | 2·76 |
| Spring (Apr. to June) | | 53·14 | 3·11 | | 53·47 | 7·10 | | 52·15 | 5·38 |
| Summer (July to Sept.) | | 59·31 | 5·94 | | 58·95 | 13·52 | | 57·18 | 11·46 |
| Autumn (Oct. to Dec.) | | 46·77 | 10·61 | | 46·56 | 5·53 | | 40·76 | 3·25 |

NOTES. 1827.—The coldest *February* but one in the cycle: compare 1830, 1836, 1838, 1841; and *March* among the wettest: compare 1836, 1839. *April* the driest but one: compare 1839. *June* the driest but one: compare 1826. *July* among the warmest: compare back and forward. *September* very warm and dry. *October*, of the warmest and wettest: compare the rest. This is the middle year of five in succession having the barometrical average *above the mean of the cycle*: compare 1837 in Note.

1828.—The wettest *year* but one, and of the two warmest: compare 1826, also 1834: the *July* the wettest *month* in the cycle: compare 1827, 1834. Note, also, the gradation from year to year in the mean temperature of summer (first rising and then falling) through the space from 1824 to 1829. In the spring temperature, with a single exception, the like rise and fall. *April* was among the wettest: compare 1825. See figs. 5 and 6.

1829.—A cold year, and of the driest. *January* among the coldest of the cycle; and of the driest. The driest *March* but one: compare 1840: and among the coldest: compare 1833, 1836, 1837, 1839, 1840. *May* the driest of the series: compare 1826, 1833, 1834, 1836, 1839. *August* the wettest of the series: compare 1825, 1832, 1833. *September* wet. *December* the coldest in the set, and of the driest: compare 1830, 1835, 1839, 1840.

Mean height of the Barometer, Mean Temperature and depth of Rain in each month, at Ackworth, Yorkshire, through a Cycle of Eighteen Years.

| | 1830. | | | 1831. | | | 1832. | | |
|---|---|---|---|---|---|---|---|---|---|
| | in. | ° | in. | in. | ° | in. | in. | ° | in. |
| January | 29·98 | 32·00 | 0·71 | 29·84 | 34·58 | 2·56 | 29·92 | 37·11 | 1·21 |
| February | 29·81 | 36·32 | 3·12 | 29·75 | 40·43 | 1·08 | 30·06 | 38·12 | 0·24 |
| March | 29·97 | 46·24 | 0·42 | 29·81 | 44·63 | 1·62 | 29·81 | 42·98 | 1·17 |
| April | 29·64 | 48·50 | 3·44 | 29·70 | 48·27 | 1·60 | 30·01 | 46·35 | 2·53 |
| May | 29·80 | 51·10 | 3·75 | 29·92 | 51·53 | 2·18 | 29·92 | 51·05 | 1·92 |
| June | 29·74 | 55·00 | 4·88 | 29·87 | 58·42 | 2·11 | 29·82 | 58·70 | 4·09 |
| July | 29·84 | 61·55 | 4·37 | 29·92 | 61·66 | 4·20 | 30·03 | 59·34 | 1·57 |
| August | 29·78 | 56·90 | 2·36 | 29·90 | 62·29 | 2·54 | 29·80 | 59·11 | 4·66 |
| September | 29·65 | 53·68 | 3·79 | 29·87 | 56·22 | 2·40 | 30·05 | 56·18 | 0·69 |
| October | 30·15 | 51·22 | 0·32 | 29·74 | 53·93 | 2·58 | 29·94 | 51·22 | 1·47 |
| November | 29·72 | 43·88 | 2·21 | 29·79 | 40·53 | 3·60 | 29·99 | 40·17 | 2·78 |
| December | 29·62 | 34·56 | 2·21 | 29·72 | 42·33 | 1·90 | 29·86 | 40·94 | 2·61 |
| Whole year | 29·81 | 47·58 | 31·58 | 29·82 | 49·57 | 28·37 | 29·93 | 48·44 | 24·94 |
| Winter (Jan. to Mar.) | | 38·19 | 4·25 | | 39·88 | 5·26 | | 39·40 | 2·62 |
| Spring (Apr. to June) | | 51·53 | 11·07 | | 52·74 | 5·89 | | 52·03 | 8·54 |
| Summer (July to Sept.) | | 57·38 | 10·52 | | 60·06 | 9·14 | | 58·21 | 6·92 |
| Autumn (Oct. to Dec.) | | 43·22 | 4·74 | | 45·59 | 8·08 | | 44·11 | 6·86 |

NOTES. 1830.—This year stands third in wetness, and shows a low temperature. *January* and *March* are again very dry, and the *February* between of the wettest! *April* to *July*, and *September*, afterwards, all show an excess of rain. The curious equality of rain, in the winter and autumn moderate, and in the other two seasons as excessive, is also worth notice. The temperature is again low, and that of *January* and *March* frosty.

1831.—The rain now falls off again, while the temperature rises. The *July* and *November* are wet, the latter in the extreme *for this side of the cycle.* The month of *August* presents a great advance in warmth upon the preceding years, and the whole year has a temperature above the mean.

1832.—This year closes the warmer series of the cycle. With a still further approach to dryness, reducing the rain to a quantity below the average, we have also a reduction of the mean temperature. The winter is of the driest, exceeded only by 1825, and *February* has the least wet of any month but one in the *cycle.* The month of *June* is of the wettest, and the rain of *August* exceeded only by the same month in 1829.

Mean height of the Barometer, Mean Temperature and depth of Rain in each month, at Ackworth, Yorkshire, through a Cycle of Eighteen Years.

| | 1833. | | | 1834. | | | 1835. | | |
|---|---|---|---|---|---|---|---|---|---|
| | in. | ° | in. | in. | ° | in. | in. | ° | in. |
| January | 30·21 | 33·66 | 0·76 | 29·72 | 43·54 | 3·70 | 29·98 | 34·52 | 1·77 |
| February | 29·41 | 41·70 | 2·76 | 30·02 | 42·06 | 0·57 | 29·60 | 40·79 | 2·69 |
| March | 29·88 | 38·45 | 1·34 | 30·11 | 44·25 | 1·49 | 29·85 | 41·22 | 1·67 |
| April | 29·72 | 46·07 | 2·78 | 30·15 | 45·17 | 1·83 | 30·06 | 45·20 | 1·06 |
| May | 30·05 | 57·93 | 0·54 | 29·99 | 53·80 | 0·66 | 29·81 | 50·35 | 2·60 |
| June | 29·70 | 58·03 | 3·11 | 29·89 | 58·77 | 1·99 | 29·97 | 57·15 | 2·28 |
| July | 29·94 | 60·42 | 1·09 | 29·91 | 62·01 | 7·03 | 29·96 | 60·53 | 0·63 |
| August | 29·87 | 56·30 | 4·50 | 29·83 | 60·20 | 2·09 | 29·92 | 61·52 | 1·55 |
| September | 29·86 | 53·03 | 1·49 | 30·04 | 55·82 | 1·83 | 29·60 | 53·95 | 2·33 |
| October | 29·74 | 48·73 | 2·76 | 29·93 | 48·92 | 0·26 | 29·66 | 45·18 | 2·47 |
| November | 29·80 | 42·93 | 1·32 | 29·92 | 45·05 | 1·16 | 29·84 | 41·70 | 2·02 |
| December | 29·53 | 43·11 | 2·61 | 30·23 | 41·42 | 1·13 | 30·11 | 35·68 | 0·12 |
| Whole year | 29·81 | 48·36 | 25·06 | 29·98 | 50·08 | 23·74 | 29·86 | 47·31 | 21·19 |
| Winter (Jan. to Mar.) | | 37·94 | 4·86 | | 43·28 | 5·76 | | 38·84 | 6·13 |
| Spring (Apr. to June) | | 54·01 | 6·43 | | 52·58 | 4·48 | | 50·90 | 5·94 |
| Summer (July to Sept.) | | 56·75 | 7·08 | | 59·34 | 10·95 | | 58·67 | 4·51 |
| Autumn (Oct. to Dec.) | | 44·92 | 6·69 | | 45·13 | 2·55 | | 40·85 | 4·61 |

NOTES. 1833.—This is a year of mean temperature, and having an average amount of rain. *January* of the driest and coldest: compare 1824, 1825, 1826, 1829, 1830, 1838. *February* wet: compare 1830, 1835, 1836, 1837, 1838. *March* dry and cold, and *April* wet. *May* of the driest, and the *warmest* of the series, but *variable*: thermometer at 80° and at 34°. *June* wet, *July* of the driest, and *August* wet: compare with the rest.

1834.—A warm year, in the *cold* period of nine; as 1829 was cold amidst the *warm* years. It has the highest barometer, and continues the tendency toward the *dry* extreme; its rains fell chiefly in *January*—(the wettest of the series, compare 1831 and 1837) and in July, the wettest, save in 1828, and *warm*. The *May* was dry, like the last, and the *October* the driest of the series.

1835.—A *year* of extreme *dryness*, second only to 1826, but the reverse of that in temperature, being of the coldest. *January* and *December* cold; and the latter, the driest *month* in the *whole cycle* of eighteen years: at this point the gradual tendency to drought ceases, and the *three* following years have each a mean amount of rain. The rain of this year falling so much in May and June, with July and August dry and warm, it may be thought to have been favourable to the crops, the general drought notwithstanding.

Mean height of the Barometer, Mean Temperature and depth of Rain in each month, at Ackworth, Yorkshire, through a Cycle of Eighteen Years.

| | 1836. | | | 1837. | | | 1838. | | |
|---|---|---|---|---|---|---|---|---|---|
| | in. | ° | in. | in. | ° | in. | in. | ° | in. |
| January | 29·74 | 36·48 | 1·65 | 29·81 | 36·54 | 3·28 | 29·86 | 29·45 | 1·00 |
| February | 29·66 | 36·19 | 2·02 | 29·76 | 41·73 | 3·16 | 29·55 | 30·25 | 3·35 |
| March | 29·38 | 39·75 | 3·39 | 29·88 | 35·79 | 0·99 | 29·70 | 41·39 | 1·40 |
| April | 29·75 | 41·90 | 1·48 | 29·51 | 39·65 | 2·00 | 29·67 | 42·78 | 1·58 |
| May | 30·17 | 49·20 | 0·68 | 29·82 | 48·08 | 1·62 | 29·84 | 48·17 | 3·38 |
| June | 29·76 | 58·86 | 2·72 | 29·90 | 56·96 | 1·51 | 29·76 | 57·54 | 2·61 |
| July | 29·81 | 59·05 | 2·33 | 29·84 | 60·58 | 2·64 | 29·85 | 60·25 | 1·82 |
| August | 29·93 | 56·87 | 0·69 | 29·82 | 57·60 | 1·39 | 29·73 | 59·24 | 2·59 |
| September | 29·75 | 53·15 | 2·10 | 29·82 | 53·03 | 2·13 | 29·92 | 53·00 | 1·41 |
| October | 29·70 | 47·50 | 1·71 | 29·94 | 49·29 | 2·08 | 29·85 | 50·10 | 3·31 |
| November | 29·45 | 39·80 | 4·67 | 29·68 | 40·88 | 1·65 | 29·47 | 39·20 | 2·01 |
| December | 29·66 | 39·54 | 1·77 | 29·82 | 39·74 | 2·94 | 29·95 | 38·08 | 0·56 |
| Whole year | 29·73 | 46·52 | 25·21 | 29·80 | 46·66 | 25·39 | 29·76 | 45·79 | 25·02 |
| Winter (Jan. to Mar.) | | 37·44 | 7·06 | | 38·02 | 7·43 | | 33·69 | 5·75 |
| Spring (Apr. to June) | | 49·99 | 4·88 | | 48·23 | 5·13 | | 49·49 | 7·57 |
| Summer (July to Sept.) | | 59·69 | 5·12 | | 57·07 | 6·16 | | 57·49 | 5·82 |
| Autumn (Oct. to Dec.) | | 42·28 | 8·15 | | 43·30 | 6·67 | | 40·85 | 5·88 |

NOTES. 1836.—A *cold* year, the rain an average: a wet *February* and very wet *March*; with *April* and *May* dry: compare 1826, 1827, 1830, 1833, 1837, 1838, &c. The low temperature is pretty uniform through the twelve months. The *August* has the least rain of any month in the cycle of that denomination, and *November* the most: compare 1826, 1831, 1839, 1840.

1837.—The mean temperature and rain nearly as in last year. *January* and *February* in the wet extreme; *March* of the driest, and *April* reasonably wet. *December* the wettest of any in the cold years. The middle year of five *having the barometrical average below the mean of the cycle.*

1838.—The coldest *year* of the whole cycle of eighteen, chiefly due to the low temperature of the winter months: the third year in succession with rain about the average. *December* as dry as the preceding one was wet: *February*, *May* and *October* show the largest amount of rain. By *rain* the reader must, of course, sometimes understand the product of the gauge in *melted snow*: and the lying of this over, unmelted, may sometimes have thrown some excess upon the measure of the month following.

Mean height of the Barometer, Mean Temperature and depth of Rain in each month, at Ackworth, Yorkshire, through a Cycle of Eighteen Years.

| | 1839. | | | 1840. | | | 1841. | | |
|---|---|---|---|---|---|---|---|---|---|
| | in. | ° | in. | in. | ° | in. | in. | ° | in. |
| January | 29·92 | 36·82 | 1·21 | 29·62 | 36·99 | 1·92 | 29·74 | 33·47 | 1·92 |
| February | 29·46 | 39·35 | 1·94 | 29·86 | 38·38 | 1·89 | 29·74 | 36·50 | 1·03 |
| March | 29·73 | 38·70 | 3·20 | 30·23 | 39·82 | 0·11 | 29·75 | 46·70 | 0·89 |
| April | 30·09 | 44·27 | 0·52 | 30·05 | 49·85 | 1·51 | 29·76 | 46·00 | 0·98 |
| May | 29·95 | 50·00 | 0·51 | 29·83 | 51·35 | 3·67 | 29·76 | 54·28 | 3·22 |
| June | 29·82 | 56·00 | 4·72 | 29·88 | 57·26 | 1·99 | 29·83 | 54·40 | 3·45 |
| July | 29·76 | 58·00 | 5·23 | 29·74 | 57·00 | 2·71 | 29·71 | 57·00 | 4·19 |
| August | 29·91 | 57·47 | 2·57 | 29·79 | 60·50 | 2·04 | 29·75 | 61·35 | 2·62 |
| September | 29·53 | 54·00 | 3·40 | 29·64 | 51·50 | 2·87 | 29·69 | 56·28 | 4·11 |
| October | 30·00 | 47·70 | 3·54 | 29·90 | 45·65 | 0·92 | 29·48 | 47·50 | 4·24 |
| November | 29·63 | 42·00 | 4·50 | 29·50 | 41·50 | 4·61 | 29·63 | 39·94 | 2·85 |
| December | 29·64 | 36·00 | 1·82 | 30·09 | 34·48 | 0·51 | 29·53 | 39·43 | 1·33 |
| Whole year | 29·78 | 46·69 | 33·16 | 29·84 | 47·02 | 24·75 | 29·70 | 47·74 | 30·81 |
| Winter (Jan. to Mar.) | | 38·29 | 6·35 | | 38·39 | 3·92 | | 38·89 | 3·84 |
| Spring (Apr. to June) | | 50·09 | 5·75 | | 52·82 | 7·17 | | 51·56 | 7·65 |
| Summer (July to Sept.) | | 56·49 | 11·20 | | 56·33 | 7·62 | | 58·21 | 10·92 |
| Autumn (Oct. to Dec.) | | 41·90 | 9·86 | | 40·54 | 6·04 | | 42·29 | 8·42 |

NOTES. 1839.—The wettest *year* of the whole cycle, with the lowest barometer, and also cold in the extreme; but the average temperature has risen nearly a degree. If we compare the rain assigned to the "Summer," with that of the same season in the *warm* 1828, and the *cold* 1829, we shall see that the wetness of a summer is not dependent on the temperature, but springs from other causes. The *April* and *May* of this wet and cold year are the poorest in rain of any of these (taken together) in the whole cycle.

1840.—The mean temperature still a little better, the rain considerably below average: *March*, showing only 0·11 in., should seem the driest *month* of the whole *cycle*, but that *snow*, fallen in the latter days of it, may have caused some part of the measure to go to the account of *April*; which is sufficiently meagre of rain in itself. The wettest *May* but one, and the like of *November*: compare 1830, 1836.

1841.—The mean temperature still advancing; but still exceeded by all the warm-period years, 1829 excepted: the rain up again to the wet extreme. *March* was pretty dry, as were the colder months generally: the rain, as to its excess, belongs to the warmer six months from *May* to *October*. The temperature of *July* in this year falls below that of the same month in every year of the warm period, save 1832: and *September* and *October*, taken together, are the wettest since 1824. Thus we complete the *cycle*.

*By the same Author.*

# THE CLIMATE OF LONDON,

DEDUCED FROM

# METEOROLOGICAL OBSERVATIONS

MADE IN

# THE METROPOLIS

AND AT VARIOUS PLACES AROUND IT.

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Fig.2.

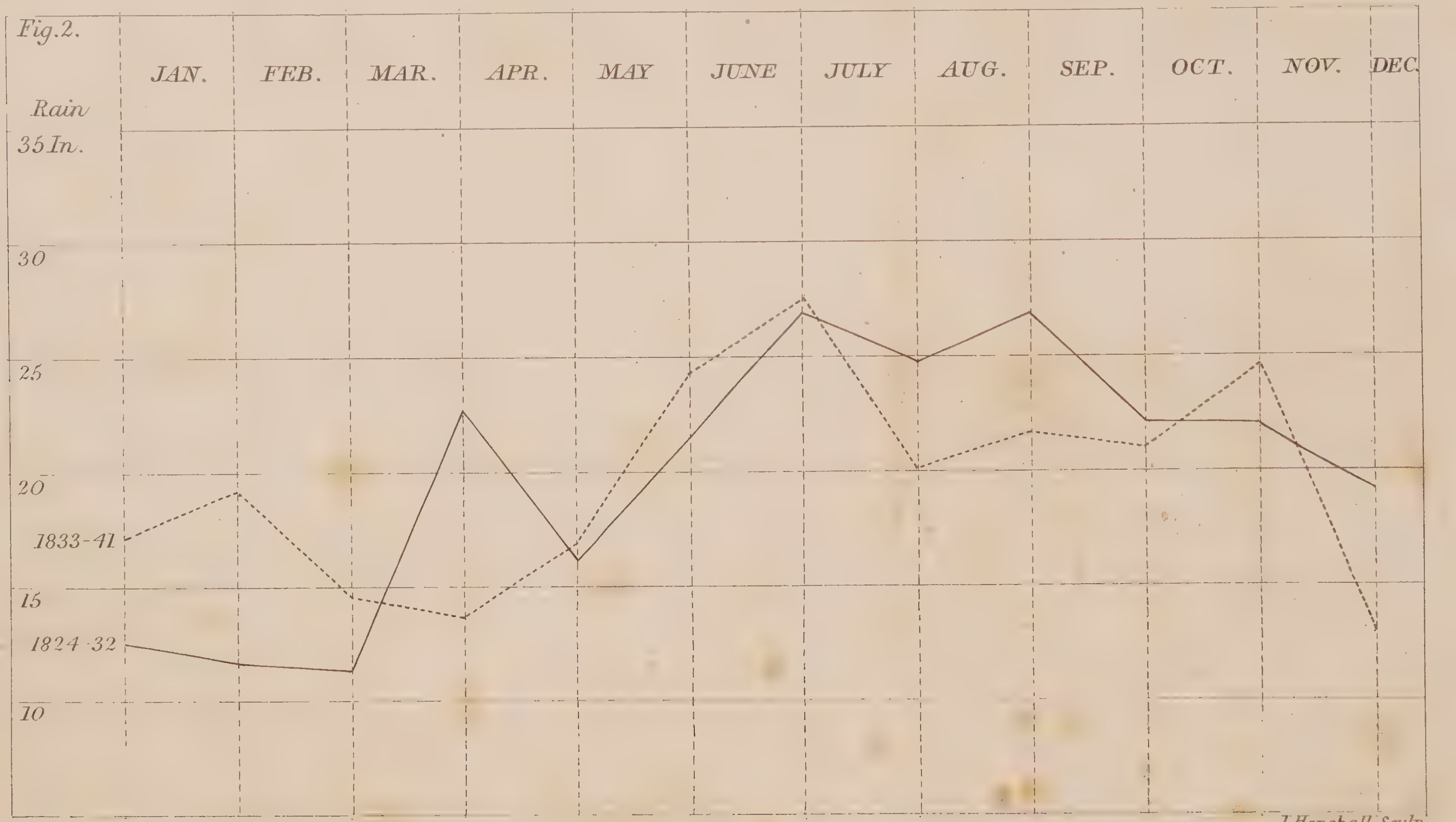

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Fig. 3.

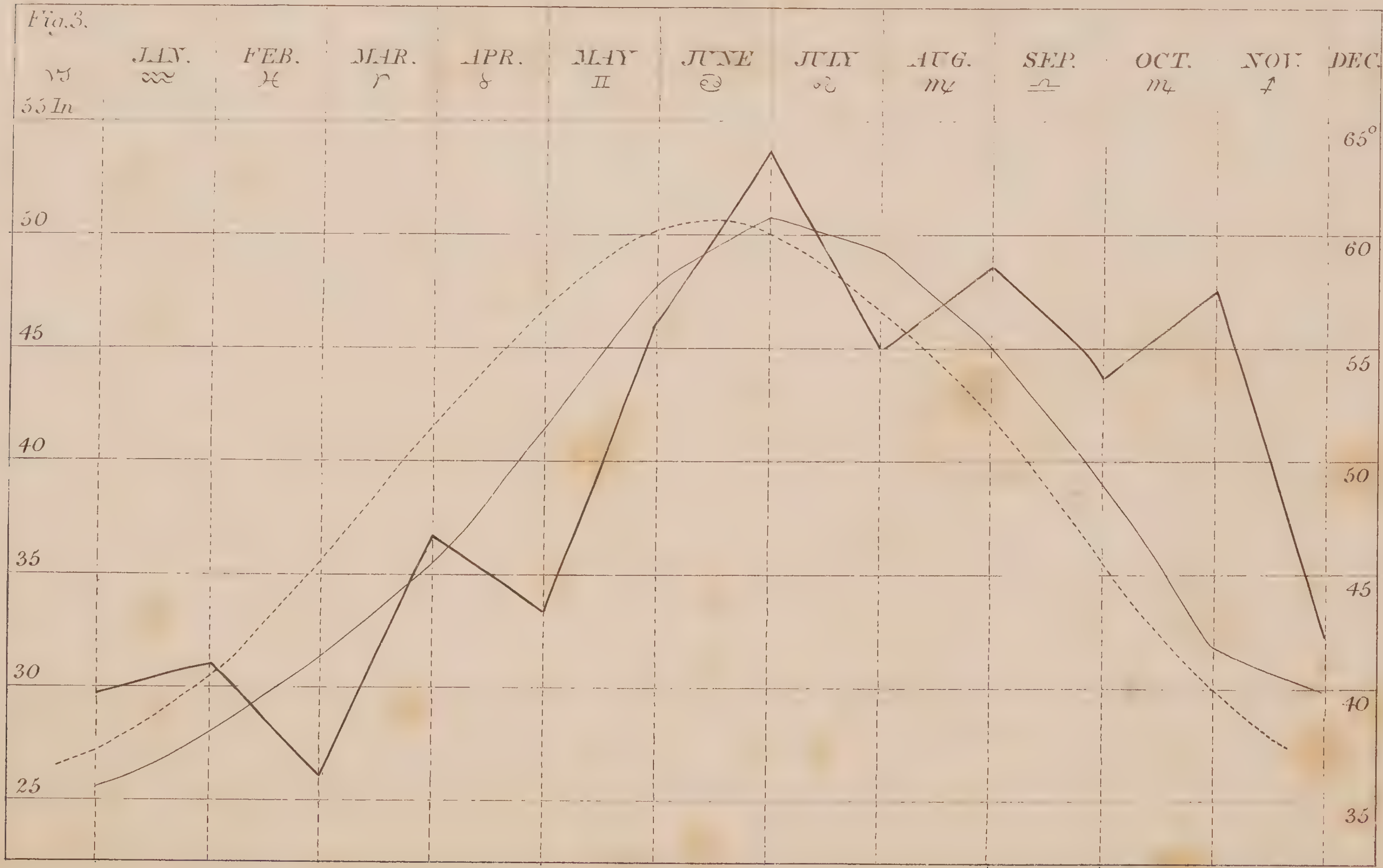

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Fig.6.

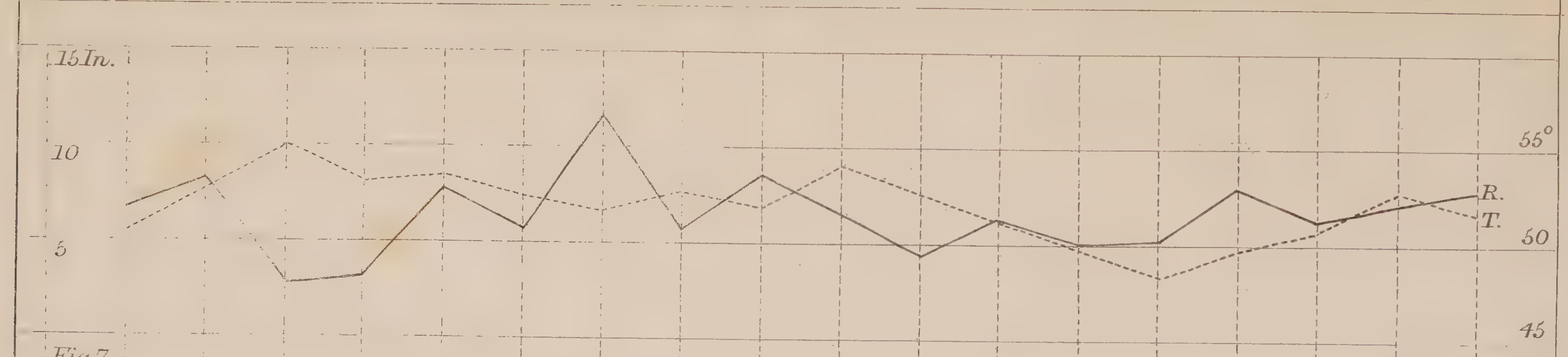

Fig.7

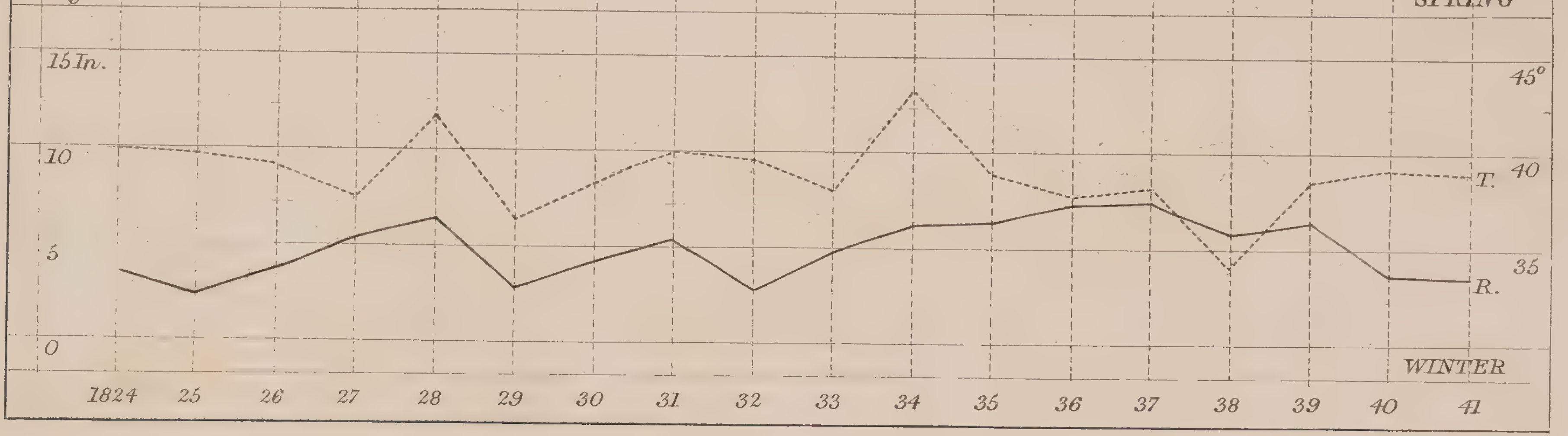

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Fig.4.

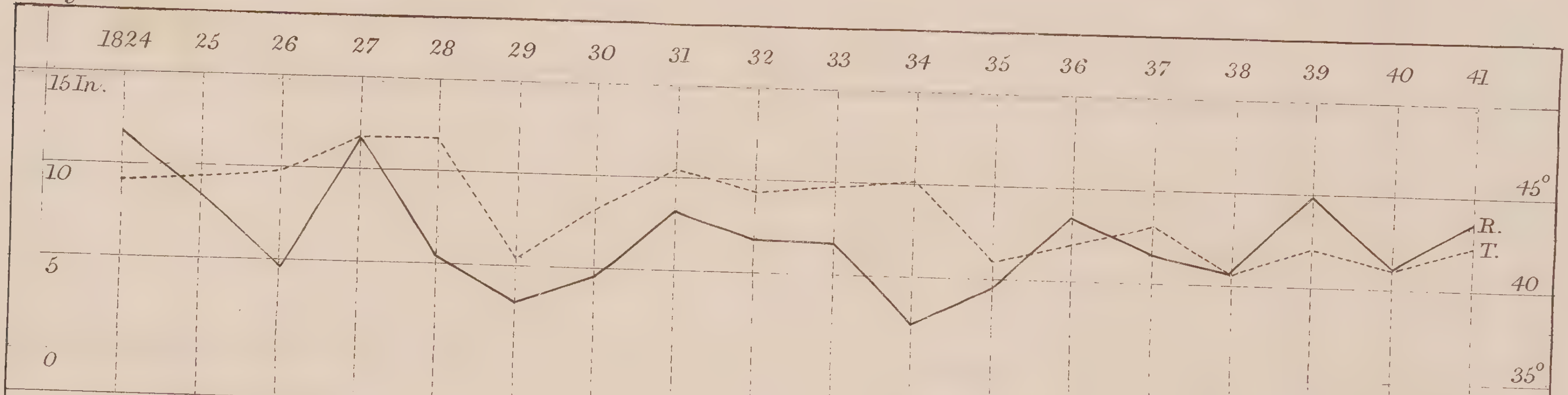
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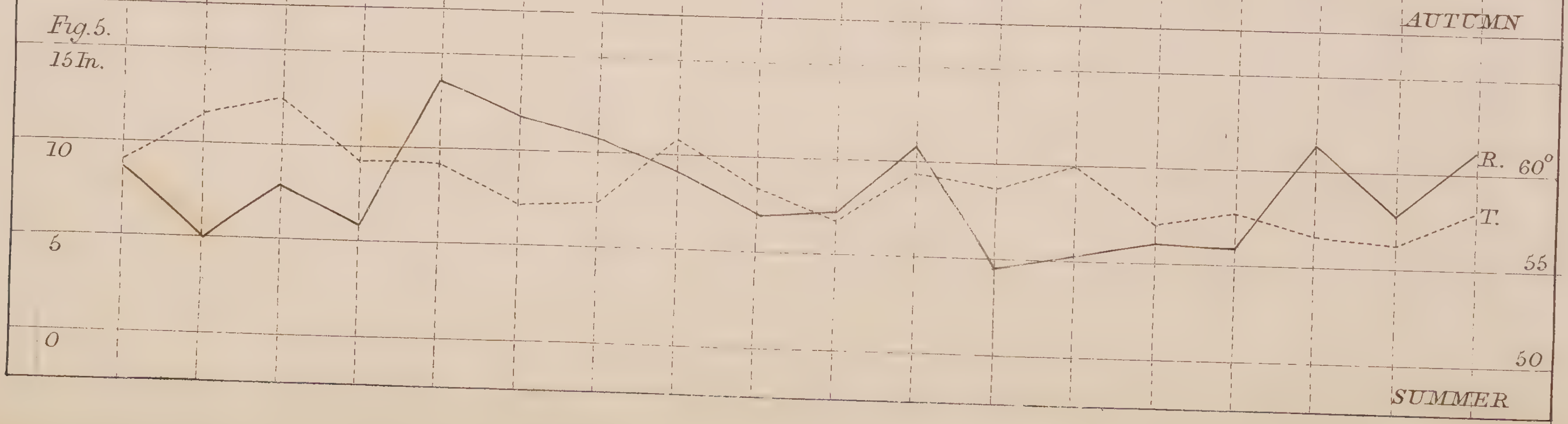
Fig.5.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